PATENT SPECIFICATION

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COMPLETE SPECIFICATION

Shaped Bodies Made of Sintered Hard Metal

We, ŠKODA WORKS, NATIONAL CORPORATION, of Plzeň, Czechoslovakia, a Czechoslovak National Corporation, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

Sintered hard metals usually have a very high degree of hardness, approaching almost that of the diamond, but they have at the same time a low strength and toughness compared with both high-speed tool steels and cast tungsten-cobalt-chromium alloys. It is obvious that for the maintenance of a stable cutting edge on tools or for ensuring an adequate life of the working implement, it suffices to impart the required high hardness only to the edge or border portion which is subjected to wear and tear. Unlike the border portions, it is desirable that the core of the tool should be as tough as possible, which would also favourably influence the working characteristics of the hard metal alloy at the tool edge.

With tool steels such characteristics, i.e. a hard outer surface and a tough core, have been obtained for instance by hard chroming, cementing, nitriding or patenting. However, the so obtained hard layer is rather thin and, if the tools are subjected to heavy wear, the hardening treatment has to be repeated frequently. A satisfactory utilisation of a tool enabling the highest rate of material removal is only possible with hard layers reaching to a considerable depth.

It has also been suggested to provide a base of a tough metal with a hard surface layer consisting of a sintered hard metal. Thus e.g. a sintered hard metal plate may be welded to a basic steel body, or a tungsten or tungsten-cobalt alloy may be applied to a steel base and thereupon be converted by carburization into an alloy of the hard metal type, or it is also possible to connect the hard metal and the core or base by pressing. Many similar possibilities of applying a hard surface to a tough core present themselves which, however, have in common the drawback that the hard metal layer tends to detach itself from the base.

In order to obtain sintered shaped bodies which are very hard at the surface and have a hard and tough core or base, according to the invention such bodies consist of one or more carbides of the hard metals included in the 4th, 5th or 6th Group of the Periodic System and of an auxiliary binding metal of the iron Group, and the outer zones of the said bodies contain a lower proportion of the binding metal, whilst the inner zones contain a higher proportion of the same binding metal. The metals included in the 4th, 5th and 6th Group of the Periodic System, which render, the so-called hard metal carbides, are: titanium, zirconium, hafnium, vanadium, niobium, tantalum, tungsten and molybdenum.

Thus, for example, if cobalt is used as a binding metal for a WC alloy, the core contains 11 to 13% cobalt, the surface zone only 5%. By a gradual or stepwise increase of the cobalt content from the surface inwards a number of intermediate zones may be formed, whereby the quality of the sintered body is further improved.

In this way a strength and toughness can be imparted which may be even double that of the outer portion. Thus e.g. the core can have a tensile strength of 220 kg/mm² against the 120 kg/mm² of the outer portion.

The manufacture of plates or other moulded bodies consisting of hard metals according to the present invention can be carried out in various ways. Thus e.g. a number of layers of hard metal powders

[Price 2/-]

with different cobalt contents can be filled into a mould and then subjected to pressing and sintering operations in the usual manner. The finished body then consists of zones with varying cobalt content. During the sintering process the zones of different cobalt content may diffuse to some extent into each other which is advantageous for the properties of the finished article.

The invention may be applied also to the manufacture of sintered hard metal bodies of large size which are built up of individual smaller members. To this purpose between the individual moulded parts to be poined together intermediate layers of hard metal powder having a higher binding metal proportion are disposed. Such intermediate layers may contain e.g. 13% Co, whilst the parts to be connected together contain only 4 to 5%. The individual parts together with the intermediate layers are then subjected to a pressing operation at a high temperature in a reducing atmosphere. The tensile strength and the toughness of such bodies is much higher than in the case where such tough intermediate layers rich in cobalt have not been used.

The invention can be applied with particular advantage to cutting tools. Those portions of the tool, which are subjected to a considerable wear, may be constituted of a sintered hard WC alloy containing only a small proportion of cobalt whilst those portions requiring a high tensile strength may be made of a tough sintered WC alloy rich in cobalt. Thus e.g. for the manufacture of a tool a single hard metal plate may be used having layers of varying content of auxiliary metal.

The accompanying drawings illustrate merely by way of example, some embodiments of standardised moulded bodies manufactured in accordance with the present invention. Fig. 1 showing a moulded body for a twist drill. Fig. 2 a tip for a cutting tool.

Referring now to Fig. 1, the whole width P of the twist drill is subdivided into different zones, and the outer zones A consist of a hard WC alloy with a low proportion of cobalt, while for the inner zone R a tough WC alloy rich in cobalt is used.

In a similar way the tool bit shown in Fig. 2 has its outer portion A made of a WC—TiC—Co alloy with a small proportion of cobalt, whilst the core portion R consists of a WC—Co alloy with a high cobalt proportion.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A shaped body of sintered har metal alloy, consisting of one or carbides of the hard metals included in the 4th, 5th or 6th Group of the Periodic System and of an auxiliary binding metal of the iron Group, wherein the outer zones of the shaped body contain a lower proportion of the binding metal whilst the inner zones contain a higher proportion of the same binding metal.

2. A shaped body of sintered hard metal alloy according to claim 1, wherein the hard metal alloy at the outer zones contains 4 to 5% binding metal, whilst in the inner zones the proportion of the same binding metal is between 11 and 13%.

3. A shaped body of sintered hard metal alloy according to claim 2, wherein the outer zones consist of tungsten carbide, titanium carbide and 4 to 5% cobalt, and wherein the inner zones are composed of tungsten carbide and 11 to 13% cobalt.

4. A shaped body of a sintered hard metal alloy according to any of the preceding claims, which is composed of individual parts of sintered hard metal which are bonded together by intermediate layers consisting of a hard metal alloy containing a higher proportion of binding metal than the parts to be bonded together.

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659,765 COMPLETE SPECIFICATION 1 SHEET

This Drawing is a reproduction of the Original on a reduced scale

FIG. 1.

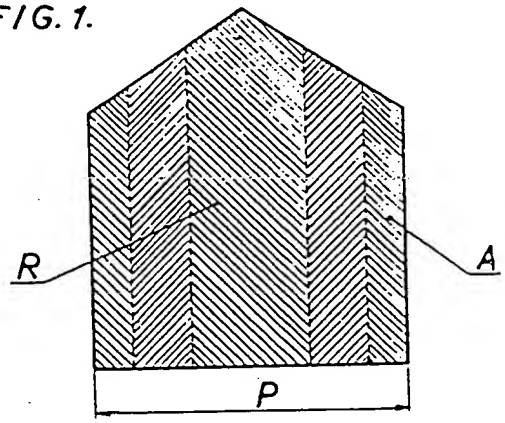
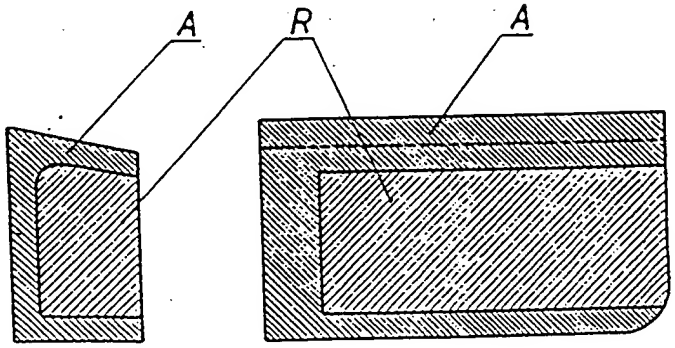


FIG. 2.



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